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**THE POSSIBILITY OF CHRONIC MANGANESE
POISONING AMONG WORKERS IN MANGANESE
MINES**

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THE POSSIBILITY OF CHRONIC MANGANESE POISONING
AMONG WORKERS IN MANGANESE MINES

(K voprosu o vozmozhnosti khronicheskikh otravleniy
margantsem sredi rabochikh margantsevykh rudnikov)

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THE POSSIBILITY OF CHRONIC MANGANESE POISONING
AMONG WORKERS IN MANGANESE MINES

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The question of chronic manganese intoxication of workers in manganese mines has been insufficiently discussed in the literature.

A. K. Rukhadze (1933) and P. M. Saradzhashvili (1947) studied the state of health of workers in the Chiatura mines, but no cases of chronic manganese intoxication (Parkinson's disease) were discovered by them.

During the past few years in the USSR, considerably greater precision has been attained in the diagnosis of manganese poisoning, and the clinical aspects of the early forms of intoxication have been studied. It has been established that Parkinson's disease is a later phase of manganese poisoning and that it is preceded by a vegeto-asthenic syndrome and by the development of single symptoms of organic affection of the central nervous system (L. N. Gratsianskaya, M. N. Ryzhkova, E. A. Drogichina). On account of this circumstance, it became necessary to make repeated studies of the state of health of workers engaged in the mining of manganese.

During 1955 -56, we carried out at Chiatura (Georgian SSR) out-patient neurological investigations of 972 workers in the manganese mines (about 200 were investigated jointly with L. N. Gratsianskaya). 50 persons, in whom there was suspicion of manganese intoxication, were investigated under clinical conditions. Among these persons there were observed complaints of headaches

(in 28 workers), vertigo (in 26), general debility (in 21), pain in the epigastric region (in 25), a tendency to perspire (in 41), deterioration of the memory (in 6), palpitation and pain in the chest (in 11), debility in the lower extremities (in 5), hypersalivation (in 5), somnolence (in 4), speech difficulty (in 2), and insomnia (in 5). Objectively, amimia or hypomimia was observed in 14 patients, asymmetry of the nasolabial line in 17, increase of the axial reflexes in 9, asymmetry or decline of the tendinous and abdominal reflexes in 17, increase of muscular tone of an extrapyramidal character in 19, the cogwheel symptom in 9, persistent red dermographia in 15, a slight hypertrophy of the thyroid gland in 9, slight tremor of the fingers when the arms were stretched out in 13, and acrocyanosis in 12 patients. In individual cases, a weakness in convergence and trembling with elements of intention tremor were observed.*

As for changes in the internal organs, a moderate enlargement of the liver was observed in 10 patients, a change in the acidity of the gastric juice in 8, an increase in the amount of gastric juice on an empty stomach in 22 (out of 32 studied), and a considerable decrease in the synthetic function of the liver (the Quick-Pytel test).

In the peripheral blood, an increase in the quantity of reticulocytes was discovered in 15 patients (12 - 17%), and monocytosis (10 - 12%), and a high level of the monocyte norm was found in 18. An increase in the amount of manganese in the blood (0.018 - 0.14 mg% at a norm of 0.015 mg% according to Lazarev) was found in 43 (out of 49 studied), and an increase in the amount of manganese in the urine was found in 16 patients.

On the basis of the clinical data listed above, a diagnosis of Parkinson's disease was established for three patients, the initial phenomena of encephalopathy with elements of the amyostatic syndrome were discovered in five, the syndrome of encephalomyelopolyradiculoneuritis was found in one patient, and a neurasthenic syndrome with acute phenomena of vegeto-dystonia was found

* Editor's note: This is a tremor which arises when a voluntary, coordinated movement is attempted.

in 30 patients. In the latter, against a background of functional disturbance of the nervous system there were often observed microorganic symptoms of affection of the central nervous system (a slight increase in muscular tone in separate groups of muscles, slight hypomimia, inadequate synkinesis of the arms during walking, flattening of the nasolabial line, asymmetry of the abdominal reflexes). This made it necessary to put them under dispensary observation due to suspicions of the initial stage of chronic manganese intoxication.

It is necessary to dwell in greater detail on the patients in whom organic damages of the nervous system were established. Let us give here the medical history of one of them.

Patient G., aged 27, has worked for about 10 years as a timberman in the mine. Complaints: pains in the epigastric region, vertigo, general debility, especially in the lower extremities when walking uphill or upstairs, somnolence, salivation, deterioration of the memory; these phenomena, which have already bothered the patient for 2-3 years, developed steadily and are progressing. As for illnesses suffered, the patient mentions pneumonia.

Objectively: the patient is slightly apathetic and answers questions languidly; his speech is monotonous, and he sleeps soundly. He sleeps 16-18 hours a day. There is hypomimia, auteropulsia, absence of convergence in the right eyes, flattening of the right nasolabial line, and an increase in the tendinous and periosteal reflexes, and also in the muscular tone in the upper right extremity. The cogwheel symptom is observed, as well as hypersalivation and red dermographia. General blood analysis: Hb 78%, er. 5,100,000, color index 0.18, reticulocytes 12%, 1.8,700, e. 2%, s. 62%, lymph. 23%, mon. 10%. Erythrocyte resistance: maximum 0.4, minimum 0.04. Manganese content in the blood - 0.04 mg%, in the cerebrospinal fluid - 0.04 mg% (according to the Dorfman and Shipitsin norm, from 0.001 to 0.009 mg%).

In a follow-up clinical investigation one year later, the patient displayed decreased strength in his right arm, general constraint, and a pronounced general debility. Asymmetry of the tendinous reflexes appeared also in the

lower extremities; the manganese content in the blood was 0.05 mg%.

Clinical diagnosis: chronic occupational manganese intoxication and Parkinson's disease.

Thus, in this patient there is a typical picture of affection of the extrapyramidal system, with the process progressing slowly. Having ruled out the presence of other etiological factors (infection, trauma), we took into account the occupational anamnesis, the youth of the patient, and the presence of a clinical picture characteristic of manganese intoxication, and the increased quantities of manganese in the blood and the cerebrospinal fluid, and came to the conclusion that manganese Parkinson's disease is present in this case.

Pronounced clinical signs of Parkinson's disease were observed also in two other patients. In one of these patients, an improvement occurred after he stopped working in the mine. The improvement manifested itself in alleviation of the symptoms and a decrease in the vegetative phenomena.

In five individuals there were observed symptoms of a mild, diffuse affection of the central nervous system. Most prominent among them were signs that the subcortical nodes had been drawn into the process, somnolence, slight hypomimia, heightened muscular tone of an extrapyramidal character, and a strengthening of the postural reflexes. At the same time, there was discovered in the patients an increased manganese content in the blood and a depression of the synthetic function of the liver. In the blood, moderate reticulocytosis and monocytosis were noted (V. S. Surat, A. P. Sapozhnikov, and A. P. Shilov consider these to be signs of manganese intoxication).

Having ruled out other possible etiological factors, we ascribed these cases to chronic manganese intoxication (initial forms of encephalopathy).

In 30 of the clinically studied individuals, functional disturbances of the nervous system were discovered in conjunction with individual micro-symptoms of affection of the central nervous system. It may be presumed that

in these cases this is connected with chronic manganese intoxication. In order to obtain a greater precision in this diagnosis, we consider it necessary to carry out more prolonged dynamic observations and also to organize a survey of workers in other occupational groups working underground without coming into contact with manganese. This will make it possible to exclude the influence of hard physical labor and of the environmental conditions of underground work on the organisms of the workers.

Since cases of manganese Parkinson's disease had never been diagnosed in Chiatura in the past, it was interesting to examine the reports of the Commission of Medical and Labor Experts on Chiatura City and the Chiatura Rayon for the period from 1948 until 1955.

Among the pensioners of groups I and II suffering from Parkinson's disease or chronic encephalitis, attention was drawn to six cases who had considerable background in underground work (10-15 years). The patients of this group had some of the characteristic symptoms of manganese Parkinson's disease. In view of this, as well as their occupational records and the absence in their anamnesis of any indications of infection suffered, we can assume that in these patients Parkinson's disease was caused by chronic manganese poisoning. We present an extract from the medical history of one of these patients.

Patient CH., aged 63, has been a disabled invalid of group I for 15 years, that is, since he was 48 years of age; until that age he had worked for 14 years as a face-worker in the shafts of a manganese mine. Objectively, the patient displayed an acute Parkinson's disease with comparatively mild trembling. In the anamnesis, no infectious diseases are mentioned. It was learned from the statements of the patient that he had been bothered for a long time before going on pension by headaches, vertigo, somnolence, and intense salivation and perspiration. One must assume that the illness was contracted a number of years before he obtained his disability status, that is, when he was relatively young. If these data are taken into consideration, together with the presence of some symptoms which, in the opinion of E. A. Drogichina,

L. N. Gratsianskaya, and V. S. Surat, are characteristic of manganese Parkinson's disease (predominance of vegetative changes at the onset of the illness, the absence of trembling), one cannot rule out the possibility that Parkinson's disease was caused in this patient by the chronic effects of manganese.

Conclusions

It is necessary to re-examine the hitherto existing idea that there are no cases of manganese intoxication, including manganese Parkinson's disease, among workers in manganese mines.

In an investigation of about 1,000 workers in these mines, we discovered individual cases of a mild Parkinson's disease as well as lighter forms of encephalopathy.

In a group of workers, manifestations of functional disturbance of the nervous system were discovered combined with single microorganic symptoms of injury of the central nervous system. This leads us to assume that they suffer from the initial stage of chronic manganese intoxication. Prolonged observation will be required to arrive at a final solution for the question of the etiology of these changes.

In patients with manganese intoxication, and also in the group of workers who are under dynamic observation, there is a slight enlargement of the liver together with a decline in its synthetic function, an increase in the spontaneous secretion of gastric juice; and in the blood — moderate monocytosis and retinocytosis, as well as an increased manganese content.

The results of the observation indicate that it is necessary to carry out measures to improve the medico-sanitary services and to assure healthier working conditions for the workers in the Chiatura manganese mines. Such measures are being taken at the present time.

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